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Design Thinking for Textiles: let's make it meaningful

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Abstract: The values underpinning the global textile industry are continuing to transform because of globalisation, sustainability and technological progress. This is enabled by the changes within the discipline of design itself, through the impact of design thinking on business management and leadership (Cooper et al, 2015), a move towards co-creation rather than individual authorship (Sanders, 2013; Sanders and Stappers, 2014), smart technologies (Taylor and Robertson, 2014), and greater attention to how we meet today's social needs through design (Thackera, 2013; Manzini, 2015). This paper is concerned with the impact of transformation upon the role of the textile designer and design educator. Discussion draws on recent design research in Smart Textiles, E-Co Textiles and the sustainability agenda, future craft and designer's thinking, revealing a set of values underpinning the contemporary craft of textile design, facilitating a conversation as to how they relate to the active concept of authenticity.

Keywords: values; craft; smart textiles; circular economy; collaboration;

1. Introduction

The world in which we live is changing at an alien pace, yet human beings are not biologically evolving at a speed akin to this. Advanced technologies are changing how we interact and what we interact with, but it cannot (yet) translate the emotional, sensorial and spiritual qualities of life and embed them into a textile design. A human being brings these human qualities to bear on materials.

Elaine Igoe (2010; 2013) presents textile design as a sub-discipline within design, which has unique ways of thinking and therefore designing associated with it. These unique and sometimes complex ways of thinking demand different approaches to design and therefore have a different set of values attached. In this exploratory research paper, we seek to share an attitude and series of values that are the foundation of imagination and creation in textile design research. The objective is to begin to

unpack contemporary routes to authentic contemporary craft practices. We begin with a brief literature review of modern textile design process to provide context to the changing world. We ask:

How and in what way(s) does integrating new technologies, topics and-or methods change the authenticity of a textile design? Discussion draws on recent design research in Smart Textiles, E-Co Textiles and the sustainability agenda, future craft and designer's thinking, revealing a set of values underpinning the contemporary craft of textile design, facilitating a conversation as to how they relate to the active concept of authenticity. We discuss the textile topics collectively – e: textiles, sustainability and participatory practices; nurturing a plurality of perspectives to enable a disruption of cultural norms to create ambiguity which is deemed necessary within design thinking for innovation. Our position is cognizant of the rich discussion of values in craft literature (Dormer, 1994; Howes, 2010; Metcalf, 2007; Woolley, 2010; Verhoeven, 2010; Stevenson, 2012; Yanagi, 1978) that focuses on the creative process and its products, exploring values such as beauty, cultural understanding, demonstration (or learning through experience), failure, honesty, making, self-discovery, and tacit knowledge. We seek to complement this work by attending to values in the context of modern practices, which are increasingly but not solely interdisciplinary.

Today, the meaning and authenticity for textile design is dynamic which brings with it a challenge for textile designers and design educators to find new ways to respond to these changes. In this paper, we take the position that values are not 'set' rather they are discovered or uncovered through practice and experience. We also take the position that mobilising a diversity of ideas leads to innovation.

2. The Textile Design Process

Textile design is distinct and interdisciplinary in nature, but often the textile designer is invisible, the design process often unarticulated and, consequently, the ubiquitous nature of textiles in our everyday lives results in textiles being an unsung hero of materials.

Today, a textile designer is responsible and involved in part of the process that makes-up the entirety of a clear majority of our products. Designing textiles involves a concern with the construction of different materials, and this construction in-turn provides designers with the aesthetic and functional properties to create a new material with unique qualities. Traditionally a textile provides a functional purpose and encompasses a beauty and aesthetic value that is designed in, through an understanding of the craft. The ability to create a material with inbuilt structural, performative, functional and aesthetic qualities means that they are inherently adaptable to all kinds of product areas. These areas proliferate around fashion, interior, automotive, architecture (construction industry) and, health and wellbeing.

Making sense and meaning of new directions and values afforded to the textile designer of the future is a challenge. It requires a fresh look. Today, textile designers are looking for opportunities to design by facilitating change, or to design by educating people as well as using design skills to create alternative products, services and experiences. Why? Well, for example, it has been argued that the implementation of collaborative methods in textile design practice might ensure products align

with the goals of sustainable design, for low impact and enduring life spans (Fletcher, 2008). The focus is towards an increase in use of co-design methods (Ballie, 2014; Vuletich, 2012). It is also argued that only through ambitious and inventive collaborative methodologies can cultural change become possible, which is deemed crucial when driving the agenda for sustainability as a key concern within the fashion industry. Yet what this does is to change the textile design process and this often requires a personal journey in the first instance, for textile designers to identify their own values through processes of making, which run parallel or are aligned to the needs of others (Politowicz, 2013). This requires a human or person centred approach to innovation with design capabilities at the heart - empathy, visualisation, prototyping, synthesising, communication, and evaluation.

3. Textile Design

Textile design is distinctive in so far that its process is guided by emotive, haptic, sensorial and tactile qualities. Textile design is becoming 'smart' with a surge in innovative collaborations (Igoe, 2013). It leans towards an inherently interdisciplinary methodology, involving two or more fields of study. Pioneering interdisciplinary textile projects include the sKINship research project¹, where interdisciplinary work has sought to bring together the fields of Reconstructive Plastic Surgery and Pattern Cutting, using 'making' as a language to create and share knowledge. Another example is Professor Helen Storey's 'Catalytic Clothing'² (2011-present), which explores how clothing can act as a catalytic surface to purify air. What we are witnessing – through interdisciplinary projects that are bringing art, science and design together - is a shift in functionality and in the making process, with a larger proportion of time spent in the concept development phase. And, because the technology is still emerging there is not the capability to manufacture these textiles; they must be handmade.

Within interdisciplinary project work can be higher levels of collaboration and knowledge exchange which is another increasing trend in design and design education. Within the discipline of textiles, collaborative practice is a value as it has shown to be advantageous for pushing the boundaries of creative practice. Dr Sara Robertson's work with Sarah Taylor (Figures 1 and 2) is an example of a collaborative research project (2014). It offers insight into how the form and nature of textile design is progressing. With respective expertise in printed textiles and thermochromics (temperature-activated, colour change systems), and in constructed textiles and fibre optic lighting technologies, as a collaboration they engage in a process of sharing knowledge through making³. Within this work, the 'smartness' of technical novelty is replaced with a concern for the intellectual and creative potential of interweaving new concepts, materials and technologies. This approach - the fundamental craft value - informs their work, providing a different framework from which to analyse and evaluate qualities such as innovation and aesthetics, in its process as well as its products.

¹ <http://skinship.co.uk/about/>

² See <http://ualresearchonline.arts.ac.uk/view/creators/Storey=3AHelen=3A=3A.html> and <http://catalytic-clothing.org/home.html> for further details

³ 'Digital Lace' was initiated through a call from the Crystals Project, a European research network. See <http://www.crysalis-network.eu/> for further details.



Figures 1(left) & 2 (right): Digital Lace on display at International Symposium of Wearable Computers in Seattle 2014, where it won the Design Jury Prize for Fibre Arts. Images: Sarah Taylor

A second example can be found through a review of the wider fashion system, where we can see changes also emerging in response to a call for a more circular economy. Within the UK alone, we dispose of approximately 10,000 garments every ten minutes (Kerr and Foster, 2011). Conventional methods of dealing with these issues have been cited as being symptoms based; they have not addressed continuous and rising consumption levels. These garments are designed in response to regularly changing trends that enable quick profit, rather than radically re-thinking new ways of designing (Niinimäki and Hassi, 2011). Value needs to be placed on consumer use, attachment and stronger 'user-product' and 'user-manufacturer' relationships (Chapman, 2006; Niinimäki and Hassi, 2011). Due to the low cost of high street fashion combined with a lack of service offers post consumption, it has become more cost effective to dispose and replace a garment once it has served its purpose. The whole economic system in the industrialised world, is based on a product's fast replacement and planned obsolescence (Jackson, 2011) and the field of fashion and textiles is no exception. The concept of planned obsolescence prompts the shortened life cycle of products to ensure a market need for future products (Walker, 2011). There is further disparity through disconnection between the designer, the process of manufacturing, and the consumer who is often left unsatisfied long term, which exacerbates the situation by encouraging the rapid replacement of products.

There is limited literature relating to the specific role of ethics within the fashion or textile industry from a designers perspective; acknowledging their responsibility within the supply chain and the

lifecycle of a garment. Traditionally fashion designers do not write, or theorize; they cut and make (Thomas, 2001:4). Whilst interrogating the *modus operandi* of the fashion industry, there could also be an interrogation of sustainability and the circular economy, and what it could mean if universally adopted by design practitioners, and by the fashion/textile industry in general. While the work of Black (2012), Fletcher (2008), Tham and Jones (2008) and Lee (2006) have expanded upon this territory within a fashion context, Fletcher (2010), a founding scholar of the slow fashion movement calls for a re-examination of the entire design, production and distribution process. Prior to these publications, fashion design practitioners and the industry have had to adapt and co-opt sustainability arguments and theories from product design and architecture design writers, such as Chapman (2006) and Manzini (2005; 2015).

Fast fashion, both in terms of product and activity, challenges the concept of sustainability. *'Fashion clothes capture a moment in time and are as quickly forgotten. But what if that moment was not one but many moments...a process of transformation?'* (Earley and Fletcher, 2003). Contemporary research positions textile design as an intervention and seeks to achieve more sustainable consumer activity through longer-term consideration and connectivity towards fast fashion purchases. Through evaluation of the process of designing, developing and demonstrating textile design interventions a new proposition emerged titled 'e-Co-Textile Design' (Ballie, 2014). This model demonstrates how social and digital media can provide a vehicle for textile designers to facilitate participatory experiences through sharing processes of making and constructing communities of practice online: a change in practice deemed necessary if issues of waste, for example are to be mindfully reduced

Through understanding co-design as a method, research can orchestrate textile design interventions and individuals, enabling them to personalize clothing concepts and participate in making (Figure 3). This enables questioning of both the participants' and textile designer / researchers relationship with fast fashion to address sustainability. What we know from this work is that the issues raised by demystifying the design process are considerable; the experience of working with individuals allows the researcher to develop a deeper understanding of their needs, desires and aspirations by asking them questions. As such, the textile process transitions beyond only crafting beautiful products, moving towards designing new interactions of use to encourage longer relationships with clothing. In this way we can see why, how and where textile design is being developed as a strategy for changing people's behaviour and is a concern for crafting new partnerships, relationships and alternative ideas.

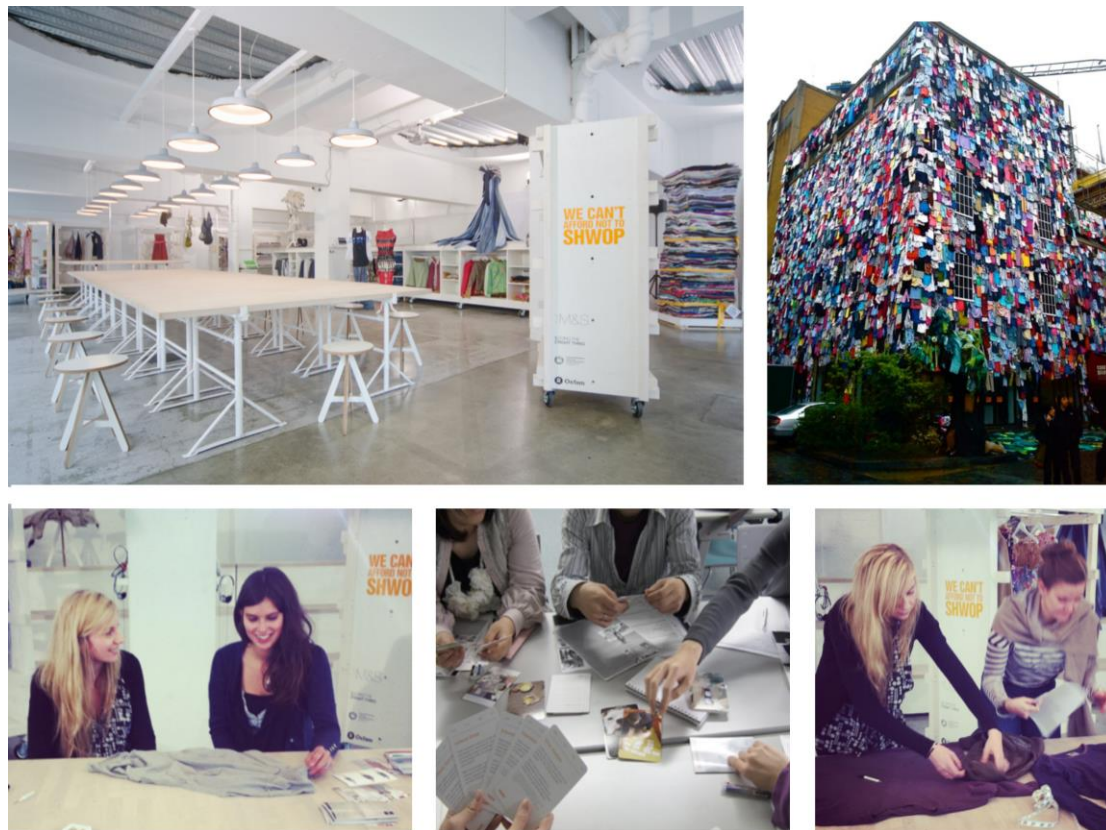


Figure 3: An example of a co-design experience: Unpick and Remix – Shwop Lab, Marks and Spencer (Ballie, 2014).

As a strategy for modernisation and organizational change, design has travelled a long way in a relatively short period of time in terms of how it is understood most especially among academics, business executives, and politicians (Borja de Mozota, 2006; Buchanan, 1995, 2014; Brown, 2008, 2015; Cooper, Junginger and Lockwood, 2015; Evans and Chisholm, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011; Michlewski, 2015; Moggridge, 2007; NextDesign Leadership Institute, 2011; Norman and Verganti, 2014; Earley and Goldsworthy, 2016). Yet the value of design as a strategy for innovation and transformation within the context of science has made less progress. Yes, there are detailed accounts of new product development for medical equipment (Brown, 2013), new textile products for treating injuries for use in surgical contexts and for anti-bacterial and anti-microbial finishes to fight infection (UKFT, 2011: 57), and animated visualization of complex diseases and bodily behaviours to support communication between cancer patient and clinician (McGhee and Valentine, 2007). Within healthcare and wellbeing there are recent examples of wearable ‘technologies’ that focus on how we might re-design our experiences of ill health and recovery, such as Sarah da Costa’s ‘Material Pharmacy’ project, exploring new ways of administering breast cancer treatment⁴; Professor Nick Taylor’s ‘Wearable Assistive Materials’ inter-disciplinary project exploring how new materials

⁴ Da Costa - a pharmacist and designer, and her ‘Material Pharmacy’ project was conducted during her Masters programme at Central St Martins, London⁴, in collaboration with Dr Ipsita Roy, UK Reader of Microbial Biotechnology at the University of Westminster, UK. The project explored microencapsulation of the cancer drug Tamoxifen within a biopolymer. This biopolymer is inserted into the cups of a specially designed bra where it makes direct contact with the skin through a fine silk mesh, transferring the drug to the affected site locally. This has fewer side effects for the patient and has the potential to dramatically shift the experience of cancer treatment.

could support walking and improve mobility to people currently reliant on wheelchairs⁵; the design of thermal protective clothing for extreme environments (Salim et al., 2014); body monitoring in sporting and medical contexts (Cecconi et al. 2014; Gioberto 2014; Smartlife, 2014); Therapeutic clothing (Koo 2014); and the potentiality of remote physical contact through embedded interactive technologies (Angelini et al., 2014; Cute Circuit⁶). However, on review, these projects are largely (though not completely) built around the service economy rather than the knowledge economy. Therefore, a question of interest (when considering future practices) is, how – if at all - can design and science work strategically in a sustainable manner, using the knowledge economy model to facilitate new collaborative ways of working for complex problem solving? How can we build together, new models for innovation and wellbeing? What problems require our collective collaboration?

The assumption underpinning this concept – to move craft beyond the service economy and firmly towards the heart of the knowledge economy – is that there is value in social capital and social innovation, sharing its design values and cognitive processes in untraditional craft situations and for specific non-craft scenarios, such as healthcare, sustainability, and education. Concepts - their origination, research and development - are infrequently discussed in textile design practice research or indeed, the wider culture of the craft, yet it is one of the ways in which the future of the discipline can better understand its geography of thought and potential future relevance.

Where do we begin? We begin by doing what designer-researchers do best – listening, observing and critically questioning what we see and what we know, visually, materially and intellectually. With this, we refer to a recent knowledge exchange funded R&D project (Valentine, 2014) to provide a context to discover through practice, the values underpinning strategic collaboration between textile design and science, to further understand how the two can work together on reducing the impact of Antimicrobial Resistance, deemed to be one of the most challenging global health issues of our time (O'Neill, 2015, 2014). The 'ABC' project researched and prototyped an innovative medical bra; principally designed for women following breast surgery to improve support, reduce pain and prevent infection. The research investigates how to ensure the bra design fits with how women can, want, or need to use the product in support of their physical and mental wellbeing. It is also to attend to the scientists wish to medically support the recovery process during the immediate post-operation phase of a mastectomy and not contribute to the deterioration of women's health. On the one-hand, it is a classic example of new product development yet it is also a vehicle for considering a deep concern for understanding how to develop a new model of designed innovation through collaboration.

The shared experience of designing with science and scientists directly engaged in Antimicrobial Resistance, enables emphasis to be placed on the cultural and social dimension of making – the ecosystem that is people, their nuances, behaviours, relationships, values, mind-sets and languages - what design strategist Kamil Michlewski (2015) calls 'Design Attitude'. In doing so, the evolving collaboration enables development of meaningful relationships, an understanding of each other's language, and the potential opportunity to build a new network with integrity in its relationships. For

⁵ See <http://www.instituteofmaking.org.uk/research/wearable-assistive-materials> for further details.

⁶ See <http://cutecircuit.com/collections/the-hug-shirt/> for details of the production of interaction fashion by Cute Circuit for over a decade

example, it facilitates knowledge exchange of the values underpinning idea development and innovation, opening up the development of a new group of interdisciplinary researchers, (microbiologists, mathematicians, surgeons, clinicians and designers) collectively asking, ‘How should we design for health and social care in the future especially in relation to slowing the problem of AMR?’

4. Discussion

Textile design process thinking is distinctive in so far that it is guided by emotive, haptic, sensorial and tactile qualities. Traditionally, textile designers have honed a singular methodology with minor deviations that can, for example, incorporate new techniques. It was primarily a lone journey and while this approach still has merit, it no longer has the same precedence.

Like many traditional design specialisms, it is changing and in the digital age it has propagated in form and penetration to the point it is now a normal part of many modern-day practices. As part of this transitioning the myth of the creative genius is waning and we are progressing from the era of the star designer towards the era of participatory culture (Nussbaum, 2013). As a result, the role of the professional designer is becoming more inclusive within design practice by adopting a facilitator role. Thackara (2013) argues that design for sustainability is not about designers telling people how to live, it requires a process of co-creation by providing tools and enabling platforms that make it easier for people to share resources. He continues to state that designers are learning that co-creation, rather than individual authorship is becoming a more effective way to understand and meet social needs and new tools and platforms are becoming more effective than finished artefacts.

Worbin (2010) has argued that changes being brought to the textile design profession by new smart materials demands that designers think in new ways, embracing these exciting dynamic capabilities. Building on the value of collaboration to develop innovative textiles, designers for example, engage and share experience of the annual ‘E-Textiles Summer camp’ project which, since 2011, has brought together a growing network of textiles artists, designers and researchers from across Europe, working in smart and electronic textiles. A key method and motivation has been knowledge exchange through intense residential workshops, with all participants contributing to the ‘Swatchbook Exchange’ (Hertenberger et al. 2014)⁷: an annual physical, material record of emerging practices, co-created by workshop participants which may prove to be hugely valuable for both charting the development of e-textiles, as well as providing a learning resource to grow a pan-European network of smart textile practitioners and research-led teaching for smart textiles. Smart textiles are an emerging field and while there has been growth in the area over the past two decades, it is the last five years of technological progress and textile design thinking that have had the greatest impact in-terms of the possibilities for e-textiles. The ‘Swatchbook Exchange’ demonstrates an open source approach and the sharing of physical work - a value, which is at the heart of much of the most innovative work in e-textiles. The series of e-textile swatchbooks (2013, 2014, 2015) celebrate the emerging values of a field that is inherently interdisciplinary but has routes firmly embedded in craft practice. As technology

⁷ For further details and online demonstrations of swatches created by makers during the E-Textile Summercamp 2013, visit <http://etextile-summercamp.org/2013/?cat=12>

improves and is miniaturised, as innovations happen in material science with leaps taken in material understanding and as new materials are produced, it is possible to see an increase in possibilities through textile thinking to integrate computation through a social and inclusive approach - a softer approach to technology for a new range of textile products.

Over the past decade the rise of 'maker culture' has focused on the social construction of artefacts and a sharing of practice. It is an emerging framework that is primarily motivated by fun and self-fulfilment and one offering everyone the chance to 'learn through making'. It is a way of playfully exploring the values of making, including textiles. Textile skills and the 'everyday' nature of textiles allow designer-researchers to cross social, cultural and geographic boundaries and, today they are also facilitating a crossing of technological boundaries and transforming an approach to designing electronic and smart materials / surfaces for the future. This impending landscape of designing with textiles is OPEN. Through co-operation, collaboration and an understanding of need, there is fresh opportunity to define and cement the values of this sub-discipline of textile design.

5. Conclusion

We are suggesting that to assess the authenticity of a textile design, modern textile designers and educators must:

1. further and fully consider the ethical dimension of their processes during both the making of textile design and the full cycle of consumer engagement with textiles - to enable more mindful decision-making. These are no longer someone else's responsibilities and textile design and its education has a responsibility to enable new interventions and strategies for change and innovation – within the circular economy, wellbeing of textile practitioners, smart textiles and the knowledge economy for health and social care. There is scope for much further exploration.
2. continue to openly share (ideas, knowledge, skills, resources and experiences) across subjects, geographical boundaries and languages to ascertain how we afford the opportunity to approach arts, science and technology differently through design thinking. How can 'making' support global challenges? How can it cater for unmet human needs and take on an open and sharing approach to future textile design for smart, authentic products, services, systems and economies?

This discursive paper has shared a concern with the impact of transformation upon the role of the textile designer and educator. The design research works explored here reveal a set of values underpinning the contemporary craft of textile design, and thereby facilitate a conversation as to how they relate to the dynamic notion of authenticity. The paper has not sought to provide answers per se, rather through a critical conversation it has shared different approaches to textile design research. Authenticity has emerged as a key value in textile design. It is considered to render textile design relevant and is a determinant of the level of its craftsmanship. Central to a highly authentic, inventive textile is deep thinking with an underpinning mix of compassion, empathy, pervasive curiosity,

prudence and resilience. Design thinking is not a commodity, therefore the act of making textiles is more than a series of steps on the road to new product development and innovation.

Bizarrely, authenticity is often overlooked or under discussed as an ideal in the contemporary craft practice of textile design. Yet, without its character being disclosed and consistently critiqued it remains an elusive quality to use as an aid when assessing performance. It is for this reason we bring it to the fore and linger on how and what it means and looks like in contemporary forms of practice.

This paper argues that textile designers also require a framework to support sustainability by reflecting on their actions and measuring the impact to identify the significance and highlight any future implications. It advocates for textile designers to view their methodology as a dynamic, living part of textile design; a value and an asset to be invested in, requiring adaptation and transformation as a situation demands. Enabling new participatory actions between new agents and actors requires new skills, tools, methods and values. We must analyse deeper to better understand the impact(s) of textile design thinking.

A rigorous discussion of methodology and the changing values underpinning it can offer rich insight into contemporary notions of authenticity in textiles. In terms of nurturing the capacity to design future textiles, attention towards how designers achieve the right social, cultural and environmental conditions to enable deep creativity and boost personal wellbeing are given. It is in this context that research is perceived to deepen an understanding and an approach to making textiles that moves beyond the creation of products and services and instead contributes to knowledge exchange and concept development. It affords the outcome of a textiles design process to be a question (or series of questions), a new network of collaborators, an exchange of time, resources and expertise. The social capital that can be fostered within interdisciplinary, collaborative work with craft practice at the heart, offers a grounded approach to innovation that is inclusive and considers wellbeing and sustainability to be vital components from the outset. If textile design as a discipline is to better understand its potential future relevance, then we argue that visual, material and intellectual engagement must be placed centrally, and that authenticity of purpose - process and system - must be considered a key value to nurture in textile designers and design researcher at all stages of their development.

References

- Adamson, G. (2007). *Thinking Through Craft*. Oxford, U.K.; New York: Berg.
- Angelini, L., Caon, M., Lalanne, D., Khaled, O.A., *et al.* (2014) Hugginess: Encouraging Interpersonal Touch Through Smart Clothes. In: *Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program*. ISWC '14 Adjunct. [Online]. 2014 New York, NY, USA, ACM. pp. 155–162. Available at: doi:10.1145/2641248.2641356 (Accessed: 18 April 2015).
- Baggerman, M. (2013) The Social Value of Craftsmanship. In: Michelle Baggerman (ed.). *Social Fabric*. Eindhoven, Design Academy Eindhoven. pp. 5–6.
- Ballie, J. (2014) E-co-Textile Design: How can textile design and making, combined with social media tools, achieve a more sustainable fast fashion future? Unpublished PhD Thesis, University of the Arts, London, UK.

- Black, S. (2007) Trends in Smart Textiles, in Van Langenhove, L. ed. (2007) *Smart Textiles for Medicine and Healthcare: Materials, Systems and Applications*. Abington, Cambridge, Woodhead Publishing Ltd in association with The Textile Institute.
- Bentz, V. M. and Shapiro, B. (1998). *Mindful Inquiry in Social Research*. Newbury Park, London, New Delhi: Sage Publications.
- Borja de Mozota, B. (2006). The Four Powers of Design: A Value Model. *Design Management Review*. 17(2) 44-53. DOI: 10.1111/j.1948-7169.2006.tb00038.x
- Brown, T. (2008). Design Thinking. *Harvard Business Review*, 86, 84-92. Buchanan, R. (1995). Rhetoric, humanism and design, in Buchanan, R. and Margolin, V. (eds), *Discovering Design*, Chicago: University of Chicago Press, 23-68
- Buchanan, R. (2014). Keynote Address: Leading Design: Managing the Challenge of Innovation, *19th DMI: Academic Design Management Conference*, London 2-4 September 2014.
- Chapman, J (2005). *Emotionally durable design: objects, experiences and empathy*. Earthscan, London.
- Cecconi, M., Caputo, G., Baruzzo, B. and Faletra, R. (2014) NAERO Light Your Energy. In: *Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program*. ISWC '14 Adjunct. [Online]. 2014 New York, NY, USA, ACM. pp. 33-38. Available at: doi:10.1145/2641248.2641270 (Accessed: 18 April 2015).
- Christie, R.M., Robertson, S. and Taylor, S. (2012) Design Concepts for a Temperature-sensitive Environment Using Thermochromic Colour Change. *JAIC - Journal of the International Colour Association*. [Online] 1 (0). Available at: <http://aic-colour-journal.org/index.php/JAIC/article/view/80> (Accessed: 18 April 2015).
- Cooper, R., Junginger, S., & Lockwood, T. (Eds.). (2011) *The Handbook of Design Management*. Oxford: Berg.
- Dormer, P. (1994) *The art of the maker: skill and its meaning in art, craft and design*. UK. Thames and Hudson.
- Evans, M. and Chisholm, J. (2015). Design for Europe: employing scenarios to benchmark the effectiveness of European design policy, presented at the 'The Value of Design Research', *11th International European Academy of Design Conference*, 22-24 April 2015, Paris Descartes University
- Earley, R., and Vuletich, C. (2015) A New 'T' for Textiles: Training Design Researchers to inspire Buying Office Staff towards Sustainability at Hennes & Mauritz (H & M), presented at the, *11th International European Academy of Design Conference, Crafting the Future*, Paris Descartes University, Paris, April 2015.
- Earley, R. and Goldsworthy, K. (2016) Circular Transitions: a Mistra Future Fashion Conference on Textile Design and the Circular Economy, 23-24 November 2016, Chelsea College of Arts & Tate Britain, London.
- Fletcher, K. and Tham, M. (2014) *Routledge Handbook of Sustainability and Fashion (Routledge International Handbooks)* London: Routledge
- Gioberto, G. (2014) Garment-integrated Wearable Sensing for Knee Joint Monitoring. In: *Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program*. ISWC '14 Adjunct. [Online]. 2014 New York, NY, USA, ACM. pp. 113-118. Available at: doi:10.1145/2641248.2642736 (Accessed: 18 April 2015).
- Hertenberger, A., Scholz, B., Contrechoc, B., Stewart, B., et al. (2014) 2013 e-Textile Swatchbook Exchange: The Importance of Sharing Physical Work. In: *Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program*. ISWC '14 Adjunct. [Online]. 2014 New York, NY, USA, ACM. pp. 77-81. Available at: doi:10.1145/2641248.2641276 (Accessed: 18 April 2015).
- Hill, J. E. (2015). The circular economy: from waste to resource stewardship, part I. *Proceedings of the ICE - Waste and Resource Management*, 168(1), 3-13. <http://doi.org/10.1680/warm.14.00003>
- Howes, D. (2010) *Sensory basket weaving 101* In: Alfoldy, S., ed. *NeoCraft: Modernity and the Crafts*. Halifax. The Press of the Nova Scotia College of Art and Design, 216-224.
- Igoe, E. (2010) 'The tacit-turn: textile design in design research'. *Duck Journal for Research in Textiles and Textile Design*, Vol 1, pp. 1-11.
- Igoe, E. (2013) *In Textasis: Matrixial Narratives of Textile Design*. Unpublished doctoral thesis, Royal College of Art, London, UK.
- Johansson-Sköldberg, U., Woodilla, J., & Çetinkaya, M. (2013). Design Thinking: Past, Present and Possible Futures. *Creativity and Innovation Management*, 22(2), 121-146. doi: 10.1111/caim.12023
- Kimbell, L. (2011). Designing future practices, a paper presented at *Making Crafting Designing conference at the Akademie Schloss Solitude*, Germany.
- Koo, H. (2014) 'TellMe': Therapeutic Clothing for Children with Autism Spectrum Disorder (ASD) in Daily Life. In: *Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program*. ISWC '14 Adjunct. [Online]. 2014 New York, NY, USA, ACM. pp. 55-58. Available at: doi:10.1145/2641248.2641278 (Accessed: 18 April 2015).

- McGhee, J. and Valentine, L. (2007) Reflections: the role of the computer artist in communicating and visualising Magnetic Resonance Imaging (MRI) of arterial disease imagery. In: Pollier-Green, P., Van de velde, A., and Pollier, C. [Eds] (2007) *Confronting Mortality with Art and Science*. Brussels: VUBPRESS Brussels University Press.
- Malins, J., Steed, J., Fairburn, S., Robertson, S., McIntyre, S., Cruickshank, L., & Scott, K. (2012) Future Textile Visions: smart textiles for health and wellness. Available from OpenAIR@RGU [Online]. Available from <http://openair.rgu.ac.uk> (Accessed 14 March 2014).
- Manzini, E. (2015) *Design, When Everyone Designs: an introduction to design for social innovation*. Cambridge, Massachusetts; London, England: The MIT Press
- Metcalf, B. (2007) *Replacing the myth of modernism*. In: Alfoldy, S., ed. *NeoCraft: Modernity and the Crafts*. Halifax. The Press of the Nova Scotia College of Art and Design, 4-32.
- Michlewski, K. (2015) *Design Attitude*. England, UK: Gower.
- Nussbaum, B. (2013). *Design Attitude*. England, UK: Gower.
- Moggridge, B. (2007). *Designing Interactions*. Boston, USA: Massachusetts Institute of Technology.
- NextDesign Leadership Institute, 2011. *Next Design Geographies: Understanding Design Thinking 1,2,3,4* <http://www.humantific.com/nextd/> http://issuu.com/nextd/docs/nextdfutures2011_v02 Accessed 4 October 2015
- Norman, D. A., & Verganti, R. (2014). Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change. *Design Issues*, 30(1), 78-96. doi: 10.1162/DESI_a_00250
- O'Neill, J. (2015). *Rapid Diagnostics: Stopping unnecessary use of antibiotics, 2015*. Commissioned Review (UK) by HM Government and Wellcome Trust.
- Politowicz, P. (2013) A Manifesto for Strategic Change. Professorial Platform 2013. University of the Arts London.
- Salim, F., Prohasky, D., Belbasis, A., Houshyar, S., et al. (2014) Design and Evaluation of Smart Wearable Undergarment for Monitoring Physiological Extremes in Firefighting. In: *Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program*. ISWC '14 Adjunct. [Online]. 2014 New York, NY, USA, ACM. pp. 249–254. Available at: doi:10.1145/2641248.2666716 (Accessed: 18 April 2015).
- Sennet, R. (2008). *The Craftsman*. New Haven: Yale University Press, 2008
- SmartLife (2014) *SmartLife Wearable Tech* [Online]. Available at: <https://youtu.be/IIPB5uy9AQA> (Accessed: 13 April 2015).
- Stahel, W. (1976). Report to the European Commission, written 1976 published 1981 as Stahel Walter R and Reday-Mulvay, Genevieve, Jobs for Tomorrow, The Potential for Substituting Manpower for Energy by Vantage Press. New York NY
- Stevenson, F. (2012) Making Changes: applying heuristics to a practice-led investigation of creative wellbeing within the context of contemporary craft. Unpublished Thesis, University of Dundee, UK.
- Tao, X. ed. (2001) *Smart Fibres, Fabrics and Clothing: Fundamentals and Applications*. Abington; Boca Raton, FL, Woodhead Pub.; CRC Press.
- Taylor, S. and Robertson, S. (2014) Digital Lace: A Collision of Responsive Technologies. In: *Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program*. ISWC '14 Adjunct. [Online]. 2014 New York, NY, USA, ACM. pp. 93–97. Available at: doi:10.1145/2641248.2641280 (Accessed: 18 April 2015)
- Thackara, J. (2013). Foreward. In J. Walker, Stuart, Giard (Ed.), *The handbook of Design for Sustainability* (p. xxv). New York, New York, USA: Bloomsbury.
- Thomas, S. (2015) "Hacking the Circular Economy" The RSA Great Recovery Blog 2nd April 2015, accessed May 12, 2015 <https://www.thersa.org/discover/publications-and-articles/rsa-blogs/2015/04/hacking-the-circular-economy/>
- Valentine, L. (2014) *Asymmetrical Bra*. Unpublished. Innovation Portal: University of Dundee.
- Verhoeven, G. A. (2007) *The Identity of Craft: Craft is Dead, Long Live Craft*. In: Follett, G., and Valentine, L., eds. *New craft future voices*. Conference Proceedings. 4th July-6th July 2010. Dundee. Duncan of Jordanstone College of Art and Design, 184-196.
- Vuletich, C. (2012) We Are Disruptive: New Practices for Designers in the Fashion/Textile Lifecycle, presented at the, 10th International *European Academy of Design Conference, Crafting the Future*, University of Gothenburg, Sweden April 2013 (Download from Academia.edu)
- Worbin, L. (2010) *Designing Dynamic Textile Patterns*. PhD Thesis. [Online]. Gothenburg, Chalmers University of technology. Available at: <http://bada.hb.se/bitstream/2320/5459/1/Linda%20Worbin-nr1.PDF> (Accessed: 5 May 2014).
- Wooley, M. (2010) *The Making: Value and values in the craft object*. In: Valentine, L., and Follett, G., *Past, present & future crafts practice*. Edinburgh. NMS Enterprises Ltd, 136-150.
- Yanagi, S. (1978) *The unknown craftsman*. Japan. Kodansha International.

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